Licensable Technologies

Carbon Nanotubes

Applications:

- Semiconductors
- Sport and recreation products
- High-strength industrial materials
- Brake pads
- High-tensile-strength fibers
- Biosensors

Benefits:

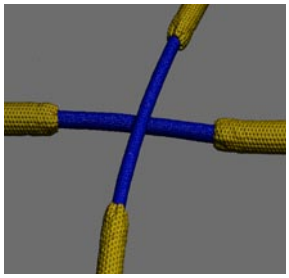
- Longer tubes enable macro-structural applications to be realized
- Separation approach much more scalable and faster than other approache

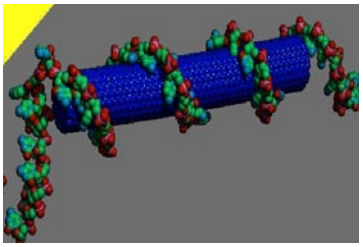
Contact:

Marc Oettinger, 505-665-9117
marc_oettinger@lanl.gov

tmt-3@lanl.gov

Technology Transfer Division





Above: Biomolecule-Based Self-Assembly
Left: New Heterostructures

Summary:

Discovered in 1991 by Japanese scientist Sumio Iijima, carbon nanotubes are cylindrical carbon molecules that are very similar in structure to a fullerene, or buckyball, but instead of being a sphere, the nanotube is tubular in shape. Two years later, single-wall carbon nanotubes (SWCNTs) were discovered.

SWCNTs have distinctive electrical, mechanical and optical properties that offer compelling advantages across several industries. These properties include

- strength and flexibility, about 100 times stronger than steel;
- light weight, less than a sixth of the weight of steel;
- small, with a 1 nm diameter, the aspect ratio of a tube is substantial;
- efficient conductor;
- efficient semiconductor; and
- near infrared (IR) emission, tunable based on size and chirality.

Scientists at Los Alamos National Laboratory (LANL), in collaboration with chemists from Duke University, have recently grown a world record, 4-cm-long SWCNT. We believe this will enable cables and large structures to be constructed using carbon nanotubes, which would be impossible or extremely challenging using current techniques.

LANL has also developed a new separation approach to identify and separate the different types of SWCNTs. Using this approach

- metallic and semiconducting SWCNTs can be separated; and
- different chiralities of SWCNTs can be isolated.

The total semiconductor market in 2003 was $168 billion. For the semiconductor industry, SWCNTs are a powerful material that can lead to smaller, faster, more efficient chips.

From microwires to logic gates carbon nanotubes have the potential to move this industry beyond current technology limitations. Nantero is a start-up company developing carbon nanotubes for use in Non-volatile Random Access Memory (NRAM). NRAM could eventually replace static random access memory (SRAM) and dynamic random access memory (DRAM), enabling instant-on computers. LANL's technology could be used to ensure that only proper types of nanotubes are used, increasing reliability and reducing costs.

Development Stage:

LANL's nanotube team currently has the generation capabilities in place to produce kilogram quantities of high-quality, designed nanotubes.

Patent Status:

Patents pending

Licensing Status:

Available for exclusive and non-exclusive licensing.

www.lanl.gov/partnerships/license/technologies/

Los Alamos NATIONAL LABORATORY ESTABLISHED 1943